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MINOR STUDIES FROM THE PSYCHOLOGICAL LABORATORY
OF CORNELL UNIVERSITY

LXI. THE AREAL AND PUNCTIFORM INTEGRATION OF WARMTH
AND PRESSURE

By IDA BERSHANSKY

This study was undertaken in the hope of resolving a difference in the results of recent investigations of the integration of warmth and pressure. Malmud had found only a close fusion of the two qualities, described at times as a warm-pressure, and at times as a pressury-warmth.¹ Cobbey and Sullivan, on the other hand, had reported a perceptive integration which they called 'oiliness'.² There was, however, a difference in method of attack. Malmud began her experiments by arousing simultaneously punctiform warmth and pressure, and her *Os* were asked to report the course of the resulting experience; she assumed that, if a perception appeared, it would be indicated. Cobbey and Sullivan first employed areal stimulation with the intent of determining the 'compulsory conditions of the oily perception', and then, after this perception was known, undertook a punctiform stimulation. They suggest that Malmud's negative finding might be explained by the difference in procedure; and we have, therefore, repeated their experiment.

Our experiment, like its original, was divided into two parts. In the first, we immersed the first joint of a finger in some oil or in warm water of known temperature, and we asked our *Os* to report the resulting sensory experience, particularly as regards the first impression, and then as regards any changes that might take place in course; they were also instructed to name the perception. In preliminary experiments we employed two *Os*, Miss G. Adams (*A*), and Miss M. E. Smith (*S*), both of whom were experienced in psychological observation; later we added as a third *O* Assistant Professor Hoisington (*H*). The *Os* were blindfolded and their nostrils were stopped with cotton-wool before they entered the experimental room. They sat with the right arm placed on an arm-rest which extended over the edge of a table, and which contained a hole through which a finger was thrust; this served to keep the arm and finger in a fixed position. The stimuli used were kerosene oil, olive oil, water, and castor oil, which were presented in the order named. The water was warmed by means of an electric coil; at the beginning of an experiment the temperature was 32° C., and during an observaion it was gradually increased to 38° C. or 40° C. The average temperature of the oils and of the experimental room was 21° and 20° C. respectively.

The procedure in a single experiment was as follows: *E* gave the signal 'now'; and then, slowly and evenly, by means of a mechanical device, raised a small glass vessel filled with water or oil, as the case might be, until the first joint of the finger was immersed; and *O* immediately began his report. The stimulation was continued for 10 min. unless *O* reported fatigue or heat. In order to remove any clue to the nature of the stimulus-object after the period of stimulation the finger was dipped in gasoline; and at the close of the experimental period the finger was washed with soap and water before the blindfold and the cotton-wool were removed.

¹R. S. Malmud, this JOURNAL, xxxii, 1921, 571.

²L. W. Cobbey and A. H. Sullivan, this JOURNAL, xxxiii, 1922, 121.

In these preliminary experiments *S* in 38 trials reported 12 perceptions, 3 when kerosene, 1 when water, 3 when olive oil, and 5 when castor oil was the stimulus; *A* in 40 trials reported only one perception of an object. Characterizations of these perceptions are:

S. Olive oil. 'Just like putting the finger in fine flour; it is an oily smooth, a sort of thin oil;' 'tiny indication of oiliness like cold cream on the hands when you have not wiped it all off.' *Castor oil.* 'It feels like warm thin butter;' 'there is a little coolness in the pressure, it may be an oily damp; now it is a little greasier than anything else, it is a sort of combination of cool wet and grease;' 'there is just a little pressure and cool, an oily damp like sticking finger into lard.' *Kerosene.* 'Feels like putting the finger in cold oil; it is not a watery wet, but a smooth wet. It is a cool and smooth pressure, an oily damp.'

Warm water. 'It is a nice smooth warm; a thinner feeling of pressure than the oily feeling; the other feels more oily, this feels thinner.'

A. Kerosene. 'Just as if I had been touched by warm jelly; I cannot say what it was because it wasn't a familiar perception.' For the rest this *O* employed such terms as 'close pressure', 'soft warm pressure', 'a pressure which sticks close around my finger', etc.

At this stage of the experiment we were puzzled by the fact that *A* reported no more perceptions, and by the further fact that *S* with a single exception failed to get the perception with warm water. A study of the reports led us to believe that the contrast between the temperature of the oils and that of the water was a disturbing factor; and, since fatigue and adaptation appeared in nearly every experiment, we decided also that the period of stimulation was too long. We therefore raised the temperature of the oils to 30° before stimulation, lowered the initial temperature of the water to the same point, and resolved in subsequent experiments to remove the stimulus as soon as *O* had reported a perception. With these changes in method, and with *H* as an additional *O*, we began another series.

In this second set of experiments *S* reported 10 perceptions in 24; *A*, 2 in 28; and *H*, 25 in 31 trials. Perceptions for all *O*s are as frequent with warm water as with any other stimulus, and also with the thinner as with the heavier oils. The characterizations of the perceptions of *S* were as before. We tried to force the perceptive attitude upon *A* by asking her every time to name the perception; but she was still unable to do this; she repeatedly reported the experience as wholly unfamiliar; and the most that she could say was, for example: "I feel something soft and warm and something heavy closing in around my finger; it felt soft, but I did not get the perception of any object;" "I get some kind of perception but it isn't anything that I know; it felt something like squeezing the finger with a rubber glove." The one other instance of a perception of object was: "It was just as if I were touched by a warm jelly; I cannot say what it was; it wasn't a familiar perception." Typical perceptions of *H* are as follows: "I cannot objectify the perception because there is nothing like it in my experience;" "I don't know what to call the perception, but it is a snug cozy something that has considerable density, and lies tightly around the finger like oil;" "it is like a semi-liquid or a heavy oil only I do not get the smoothness as when I rub my fingers together;" "it is like a dense liquid that clings closely to the finger. It might not be a liquid; I am using the term inferentially; I cannot conceive of anything as acting on my finger like this except a liquid;" "a clinging oily liquid that fluctuates in density as the warmth fluctuates in intensity;" "it is like thin butter;" "like warm molasses without stickiness, or a heavy oil that was thick."

Psychologically, our *O*s have described the experience as a fusion of warmth and pressure which may be characterized as a "warm snug pressure" or as a "warmth that sticks close to the finger." In this respect there

seems to be complete agreement with the *Os* of Cobbey and Sullivan. All these, however, named the perception 'oiliness,' whereas our *Os* were not satisfied either as individuals or as a group with any one term as a name for the perception. *S* and *H*, it is true, employed the word 'oiliness' more often than any other; and they named objects that were oily more frequently than any others; but they also named objects that are not oily, such as glue, mercury, jelly, rubber glove, and molasses. If, therefore, we accept the term 'oiliness,' it must be with some reservation. It is well known that the common perception of oiliness involves movement. In our experiment every effort was made to prevent movement of the finger during the period of stimulation; and *H* says, as we have seen, that the perception under these conditions is "like a semi-liquid or heavy oil, only I do not get the smoothness as when I rub my fingers together." Furthermore, at the close of the experiment he states: "The perception is one that we get from liquids, including oils; it is just as much like mercury or molasses without the stickiness as like oil."³

A by-product of the experiment which is of psychological interest is the course of the perception with change in degree of temperature. If the initial temperature of the water (30°) was below that of the skin, the perception was almost invariably of 'wetness.' Following this, as the temperature increased, the perception changed first to a soft, snug warm pressure which meant a thin (sometimes oily) liquid; and then, with still higher temperature, to a closer, tighter, warm pressure which carried the meaning of a thicker, denser, more viscous liquid. The higher limit in intensity was about 36°; beyond this, the warmth became dominant in intensity and clearness, and the fusion was broken up; the warmth was then felt as a 'radiant warmth with a background of pressure.' The effect of the increase in warmth was to increase the intensity, *i. e.*, the closeness, snugness of the pressure. It will be noted that, under the conditions of our experiment, pressure is felt either over the entire surface or over patches of the skin *below the surface of the liquid stimulus*. The ring of the pressure gradient is felt, if at all, only when the temperature of the liquid is approximately that of the skin;⁴ the *warmth* is felt as warm-pressure, and increase of warmth as increase in the intensity of warmth and pressure.⁵

In the second part of the experiment we employed a punctiform stimulation of warm and pressure spots. For the pressure stimulus we obtained excellent results by Cobbey and Sullivan's method of raising a hair to the vertical position; better still, by bending the hair backward. For the

³In the hope of furnishing a perception that would serve as a slight contrast to that of our experiments, and that might, therefore, aid in characterization, we occasionally and without warning exchanged the usual stimulus for one of flour warmed to a temperature of 37°. *S* reported the object of perception as 'flour or some powder,' *A*, as a granular, resisting substance; and *H*, as a dense, semi-liquid substance with a density like mercury and a clingingness more like oil.

⁴There were times when *O* did not know when his finger entered the liquid (water or kerosene), and there were also times when he got no experience while his finger was in the liquid. A ring of heat is sometimes felt when the temperature of the water is above 38°.

⁵It is, of course, possible that the pressure in this case may have its origin internally, and be referred to the surface. Internal pressure is, however, frequently reported, and we should still have to explain why increase in warmth of stimulus carries with it increase in felt pressure.

warmth we were most successful with Dimmick's electric stimulator. Our procedure was as follows. We first isolated warm spots which had a hair within their area or very near them. Then, in an experiment, we first aroused warmth; and when it was reported, raised the hair. Under these conditions we obtained a perception in 7 of 11 trials with *H*, in 5 of 24 with *S*, and in 1 of 35 trials with *A*. The naming of the perception was found to be much more difficult than in the areal experiments. Typical reports are: (*H*) "Qualitatively, I do not see much difference between this semi-liquid and the one my finger was in;" "I get the warmth and pressure beaten up in perception, it was oily in quality;" "the experience is like a drop of dense liquid; it is not wet; I don't know what to call it; it is a little like dense mercury, and a little like a heavy oil;" (*S*) "It is oily rather than wet;" "when the warmth and pressure are nearly equal I get the perception of oiliness;" "it feels a little like warm butter on the end of a toothpick. The perception does not come easily; it is hard to name it." The one perception of *A* was: "It feels sticky, like grease."

Psychologically, the experience is nearly always a warmish pressure; it is a fusion in the sense that it is unitary and yet may at any time be analysed into the two qualities. In the integration the pressure, which must be steady and not too intensive, seems to spread a little and to lose its sharpness of definition.

Conclusions. Our results appear to explain the divergence noted at the outset of this Study. There can be no doubt that the warmth-pressure integration, if it suggests an object of perception at all, most often and most naturally carries the meaning of oiliness. If, then, the *Os* are set for a one-to-one correlation of experience and perceptive meaning (and this set may be induced without any corresponding instruction from *E*), they will give a regular report of 'oily' in the synthetic experiment. In so far we agree with Cobbey and Sullivan.

But oiliness is not, under ordinary circumstances, a sheerly cutaneous perception. If, then, the *Os* are not set for perceptive report, the word 'oiliness' need never occur to them; and if they are set for perception generically only, and not specifically, they may vary in their reports,—they may fail to discover an appropriate term, or they may interchange 'oil' with such other substances as 'butter' and 'glue' and 'molasses,' or they may settle easily upon the single word 'oily.' In this way we account for the results of Malmud and for those of our present observers.

It seems, therefore, more nearly true to say that the integration of pressure and warmth is a compulsory part-condition of the perception of oiliness than to regard it as the single adequate condition.

LXII. THE INTEGRATION OF WARMTH AND PAIN

By LUCILE KNIGHT

This study forms a member of a series undertaken to discover what results psychologically when warm, cold, pressure, and pain spots are taken in pairs and stimulated simultaneously.¹ In this investigation we have worked with warm and pain spots.

¹For references to the earlier investigations, see R. S. Malmud, this JOURNAL, xxxii, 1921, 571. See also J. H. Alston, *ib.*, xxxi, 1920, 303; and L. W. Cobbey and A. H. Sullivan, *ib.*, xxxiii, 1922, 121.